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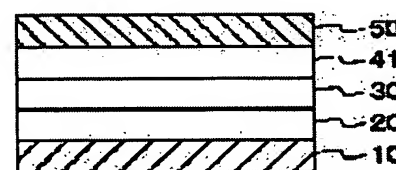
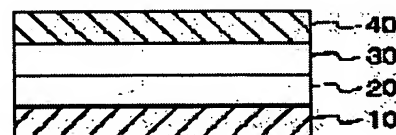
ISHII SATOSHI

(54) ORGANIC ELECTROLUMINESCENCE ELEMENT AND ITS MANUFACTURE

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an organic electroluminescence element using a wet process in forming an electron injection layer or a cathode.

SOLUTION: The electroluminescence element comprises an anode layer 10 made of a transparent material and acting as an anode; a hole transport layer 20 made of a hole transportable organic material, formed on the anode layer 10; an electron transport layer 30 made of an electron transportable organic material, formed on the hole transport layer 20; and a cathode layer acting as a cathode 40, made of tetrahydroaluminate, formed on the electron transport layer 30 by a wet process. The electroluminescent element also consists of an anode layer 10 made of a transparent material and acting as an anode; a hole transport layer 20 made of a hole transportable organic material, formed on the anode layer 10; an electron transport layer 30 made of an electron transportable organic material, formed on the hole transport layer 20; an electron injection layer 41 made of tetrahydroaluminate, formed on the electron transport layer 30 by a wet process; and a cathode layer acting as a cathode 50, formed on the electron injection layer 41.



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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] This invention relates to the manufacture method of an organic electroluminescent element, the organic electroluminescent element which used the wet method for creation of an electron injection layer or cathode in more detail about the manufacture method of the organic electroluminescent element, and its organic electroluminescent element.

[0002]

[Description of the Prior Art] Although the light emitting device of current versatility is used, field luminescence is possible and the organic electroluminescent element attracts attention from the manufacture possibility of the light emitting device of a large area.

[0003] It is expected that an organic electroluminescent element is used for the use of the display of personal computers, such as direction directions machines, tail lamps, etc., such as an automobile and a bicycle, a family computer, etc., the back light of a liquid crystal display, the light emitting device for toys, the Nighttime annunciator for road repairing, etc. from the feature.

[0004] Conventionally, the monolayer organic electroluminescent element of the structure of an anode plate / luminous layer / cathode is known for the organic electroluminescent element. From cathode, an electron is poured into a luminous layer and an electron hole is poured into a luminous layer from an anode plate. Luminescence is performed when the electron and electron hole which were poured in recombine within a luminous layer.

[0005] Then, the organic electroluminescent element with various structures is developed. For example, it is the multilayer laminated structure which consists of an anode plate / electron hole transportation layer / luminous layer / an electronic transportation layer / cathode. The electron hole transportation layer / luminous layer / electronic transportation layer is formed as a thin film.

[0006] An electron hole transportation layer is a layer for conveying the electron hole poured in from an anode plate to a luminous layer, and an electronic transportation layer is a layer for conveying the electron poured in from cathode to a luminous layer. A luminous layer is prepared between an electron hole transportation layer and cathode, and contains the fluorescent material as luminescence material. The luminous layer is formed in the fluorescent material simple substance which has high luminescence quantum efficiency, or the form distributed for these in low-molecular or a high molecular compound. Luminescence material can be used for arbitration out of the fluorescent material in which fluorescence is shown by the coloring matter for dye laser, the fluorescent brightener, or UV irradiation.

[0007] The organic electroluminescent element in which for example, the hole-injection layer, the electron injection layer, and the electron hole blocking layer were prepared in addition to the above-mentioned structure is also known.

[0008] For example, the organic electroluminescent element of a multilayer laminated structure which consists of an anode plate / hole-injection transportation layer / luminous layer / an electron hole blocking layer / cathode is indicated by JP,3-137186,A. An electron hole blocking layer is prepared between a luminous layer and cathode. When an electron hole blocking layer is not prepared, the

electron hole which does not contribute to luminescence passes through the inside of a luminous layer. An electron hole blocking layer shuts up such an electron hole in a luminous layer, and it is used in order to make it contribute to luminescence. Consequently, high luminous efficiency is acquired.

[0009] An electron injection layer is prepared between a luminous layer and cathode or between an electron hole blocking layer and cathode, and makes impregnation of the electron from cathode easy. A hole-injection layer is prepared between a luminous layer and an anode plate, and makes easy impregnation of the electron hole from an anode plate.

[0010] In manufacture of the conventional organic electroluminescent element, each organic layer was formed by vacuum deposition. However, producing the organic electroluminescent element of a large area with vacuum deposition has a problem in respect of productive efficiency.

[0011] Then, the organic electroluminescent element in which an organic layer is formed by the dip painting method of construction is indicated by the publication-number No. 137186 [three to] official report. Moreover, the organic layer is formed in JP,4-2096,A of spreading. Thereby, a possibility that productive efficiency would be improvable came out.

[0012] Moreover, coating methods, such as the casting method, the blade coat method, a spin coat method, a spray coating method, a roll coating method, and an ink jet coating method, are used for formation of an organic electroluminescent element besides the dip painting method of construction. Such a coating method is called wet method.

[0013]

[Problem(s) to be Solved by the Invention] In an organic electroluminescent element, in order for an element to form high brightness, it is required to raise the electron injection nature from cathode. In the former, in order that a high alkali metal and the alkaline earth metal of reducibility excellent in electron injection nature may raise the electron injection nature, it is used.

[0014] In the electron injection layer using a high alkali metal and the alkaline earth metal of reducibility excellent in electron injection nature, or cathode formation, the process (dry process) using a vacuum is required for all.

[0015] This invention offers the organic electroluminescent element formed in an electron injection layer or cathode using the wet method.

[0016] Moreover, the manufacture method of the above-mentioned organic electroluminescent element is offered.

[0017]

[Means for Solving the Problem] In order to solve the above-mentioned technical problem, an artificer is a chemical formula and $M(AlH_4)_n$ (among a formula). In M , an atom of 1A group except hydrogen or 2A group and n show a valence of the metal atom M . When 1 and the metal atom M of n were 2A group's atoms at the time of an atom of 1A group excluding [the metal atom M] hydrogen, n discovered that dissolution or distribution was possible to a solvent with which a tetrahydro aluminate expressed with 2 is used for a wet method.

[0018] As an example of a tetrahydro aluminate, a lithium aluminum hydride, a hydrogenation aluminum potassium, hydrogenation aluminum caesium, hydrogenation aluminum beryllium, hydrogenation aluminum magnesium, hydrogenation aluminum calcium, etc. are raised.

[0019] Moreover, the organic electroluminescent element which consists of catholyte which consists of a tetrahydro aluminate which used a wet method on an electronic transportation layer [which consists of the electronic transportability organic substance prepared on an electron hole transportation layer / which consists of the electron hole transportability organic substance prepared on an anode plate layer / which acts as an anode plate in order to solve the above-mentioned technical problem, and consists of a transparent material /, and anode plate layer /, and electron hole transportation layer], and electronic transportation layer, and was prepared, and acts as cathode offers.

[0020] An anode plate layer which acts as an anode plate and becomes others from a transparent material in order to solve the above-mentioned technical problem, An electron hole transportation layer which was prepared on an anode plate layer and which consists of the electron hole transportability organic substance, and an electronic transportation layer which was prepared on an electron hole

transportation layer and which consists of the electronic transportability organic substance, An organic electroluminescent element which consists of an electron injection layer which used a wet method and was prepared on an electronic transportation layer, and which consists of a tetrahydro aluminate, and catholyte which was prepared on an electron injection layer, and which acts as cathode is offered.

[0021] Furthermore, in the above-mentioned organic electroluminescent element, a method of one at least can be characterized by being [of the electron hole transportability organic substance and the electronic transportability organic substance] a fluorescent material.

[0022] Otherwise in the above-mentioned organic electroluminescent element, it is still more possible for it to be characterized by thing of an electron hole transportation layer and an electronic transportation layer included for a fluorescent material in a method of one at least.

[0023] In addition, it is still more possible for it to be characterized by a tetrahydro aluminate consisting of a lithium aluminum hydride, a hydrogenation aluminum potassium, hydrogenation aluminum caesium, hydrogenation aluminum beryllium, hydrogenation aluminum magnesium, or hydrogenation aluminum calcium in the above-mentioned organic electroluminescent element.

[0024] It is possible for it to be especially characterized by a tetrahydro aluminate consisting of a lithium aluminum hydride in the above-mentioned organic electroluminescent element.

[0025] Moreover, diethylether, toluene, a tetrahydrofuran, 1, 2-dimethoxyethane, a diethylene glycol, or wood ether can be used as a solvent by wet method used in the above-mentioned organic electroluminescent element.

[0026] Otherwise, a wet method used in the above-mentioned organic electroluminescent element can be characterized by being carried out by desiccation nitrogen-gas-atmosphere mind.

[0027] Furthermore, diethylether or toluene can be used as a solvent by wet method used in the above-mentioned organic electroluminescent element.

[0028] An anode plate stratification step which forms in others an anode plate layer which acts as an anode plate and consists of a transparent material in order to solve the above-mentioned technical problem, An electron hole transportation stratification step which forms an electron hole transportation layer which consists of the electron hole transportability organic substance on an anode plate layer, A manufacture method of an organic electroluminescent element which consists of an electronic transportation stratification step which forms an electronic transportation layer which consists of the electronic transportability organic substance on an electron hole transportation layer, and a catholyte formation step which forms catholyte which uses a wet method and acts as cathode on an electronic transportation layer is offered.

[0029] Moreover, it sets to a manufacture method of the above-mentioned organic electroluminescent element, and a catholyte formation step can be characterized by consisting of a step which forms catholyte with a wet method using a solution which made a solvent dissolve or distribute a tetrahydro aluminate.

[0030] Furthermore, in a manufacture method of the above-mentioned organic electroluminescent element, a catholyte formation step can be characterized by being carried out by desiccation nitrogen-gas-atmosphere mind.

[0031] An anode plate stratification step which furthermore forms in others an anode plate layer which acts as an anode plate and consists of a transparent material in order to solve the above-mentioned technical problem, An electron hole transportation stratification step which forms an electron hole transportation layer which consists of the electron hole transportability organic substance on an anode plate layer, With a wet method using an electronic transportation stratification step which forms an electronic transportation layer which consists of the electronic transportability organic substance on an electron hole transportation layer, and a solution which made a solvent dissolve or distribute a aluminate on an electronic transportation layer A manufacture method of an organic electroluminescent element which consists of an electron injection stratification step which forms an electron injection layer which consists of a tetrahydro aluminate, and a catholyte formation step which forms catholyte which acts as cathode on an electron injection layer is offered.

[0032] Moreover, in a manufacture method of the above-mentioned organic electroluminescent element,

an electron injection stratification step can be characterized by being carried out by desiccation nitrogen-gas-atmosphere method.

[0033] In addition, in a manufacture method of the above-mentioned organic electroluminescent element, it is possible to become a solvent from diethylether, toluene, a tetrahydrofuran, 1, 2-dimethoxyethane, a diethylene glycol, or wood ether.

[0034] Diethylether and toluene are able to be especially used for a solvent in a manufacture method of the above-mentioned organic electroluminescent element.

[0035] Furthermore, in a manufacture method of the above-mentioned organic electroluminescent element, a method of one at least can be characterized by being [of the electron hole transportability organic substance and the electronic transportability organic substance] a fluorescent material.

[0036] Otherwise in a manufacture method of the above-mentioned organic electroluminescent element, it is still more possible for it to be characterized by thing of an electron hole transportation layer and an electronic transportation layer included for a fluorescent material in a method of one at least.

[0037] In addition, it is still more possible for it to be characterized by a tetrahydro aluminate consisting of a lithium aluminum hydride, a hydrogenation aluminum potassium, hydrogenation aluminum caesium, hydrogenation aluminum beryllium, hydrogenation aluminum magnesium, or hydrogenation aluminum calcium in a manufacture method of the above-mentioned organic electroluminescent element.

[0038] It is possible for it to be especially characterized by a tetrahydro aluminate consisting of a lithium aluminum hydride in a manufacture method of the above-mentioned organic electroluminescent element.

[0039]

[Embodiment of the Invention] Below, with reference to a drawing, the organic electroluminescent element of this invention is explained at details.

[0040] First, the 1st operation gestalt in the organic electroluminescent element of this invention is shown below.

[0041] Drawing 1 shows the 1st operation gestalt in the organic electroluminescent element of this invention.

[0042] According to drawing 1, the anode plate layer 10, the electron hole transportation layer 20, the electronic transportation layer 30, and catholyte 40 are carrying out the laminating of the configuration of the 1st operation gestalt in the organic electroluminescent element of this invention one by one.

[0043] The anode plate layer 10 acts as an anode plate. As an anode plate layer 10, the transparent conductive material formed on the transparence insulation base material, for example, a glass substrate, is used.

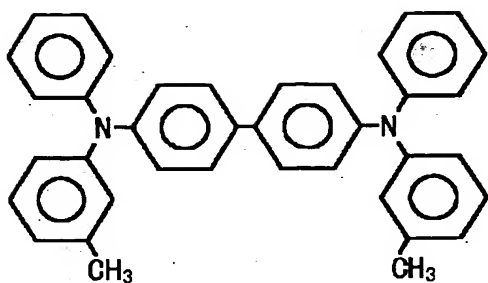
[0044] As a material of the anode plate layer 10, conductive polymers, such as inorganic conductivity material, such as metals, such as conductive oxides, such as tin oxide, indium oxide, and a tin oxide indium (ITO), or gold, silver, and chromium, iodine copper, and copper sulfide, the poly thiophene, polypyrrole, and the poly aniline, etc. can be mentioned.

[0045] Moreover, the anode plate layer 10 needs to be formed with a transparent material. This is because the colored tetrahydro aluminate is used for catholyte 40, as shown below.

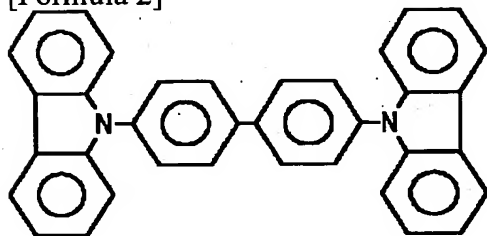
[0046] It consists of the electron hole transportability organic substance which consists of an electron hole transportation agent or an electron hole transportability macromolecule as an electron hole transportation layer 20. As for the electron hole transportability organic substance, an electron hole transportability low-molecular or an electron hole transportability macromolecule is used.

[0047] Here, as shown in drawing 3 (b), the configuration which the electron hole transportation layer 20 becomes from an electron hole transportability emitter is possible. Moreover, as shown in drawing 4 (b), the configuration which the electron hole transportation layer 20 becomes from a fluorescent material and the electron hole transportability organic substance is also possible. Furthermore, the configuration which contains the high molecular compound as a binder in the electron hole transportation layer 20 is also possible.

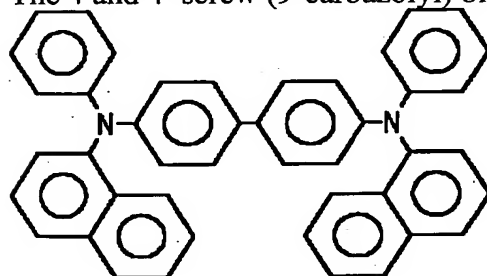
[0048] As an electron hole transportability low-molecular, it is a chemical formula [** 1].



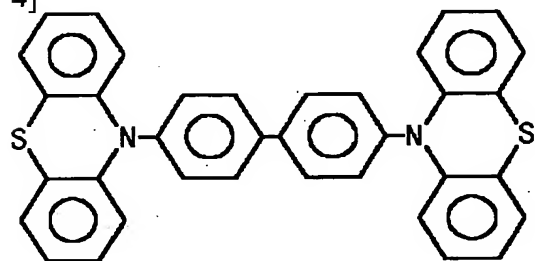
N boiled and shown, N'-diphenyl-N, the N'-screw (3-methylphenyl) -1, the 1'-biphenyl -4, 4'-diamine (it is also called Following TPD),
[Formula 2]



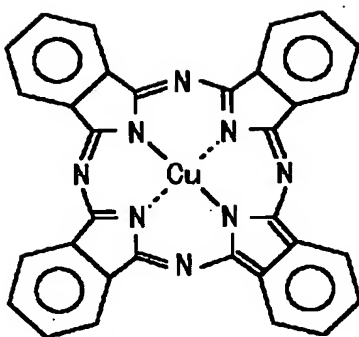
The 4 and 4'-screw (9-carbazolyl) biphenyl boiled and shown, [Formula 3]



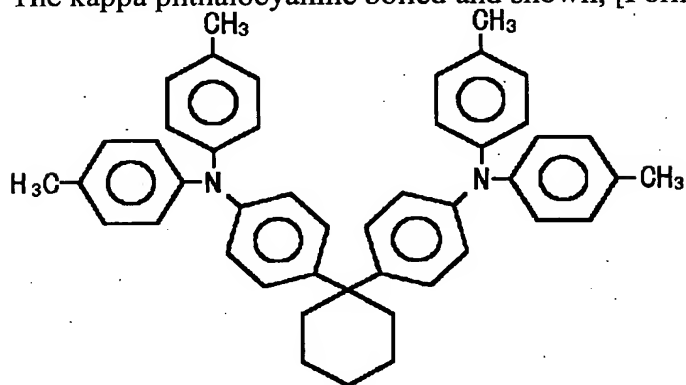
N boiled and shown, N'-diphenyl-N, N'-screw (1-naphthyl) - 1, the 1'-biphenyl -4, 4'-diamine, [Formula 4]



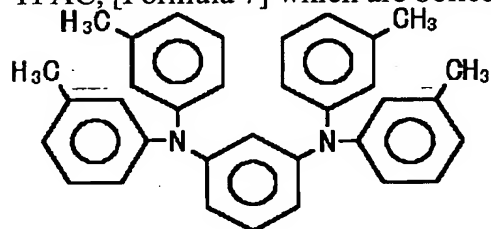
The 4 and 4'-screw (10-phenothiazinyl) biphenyl boiled and shown, [Formula 5]



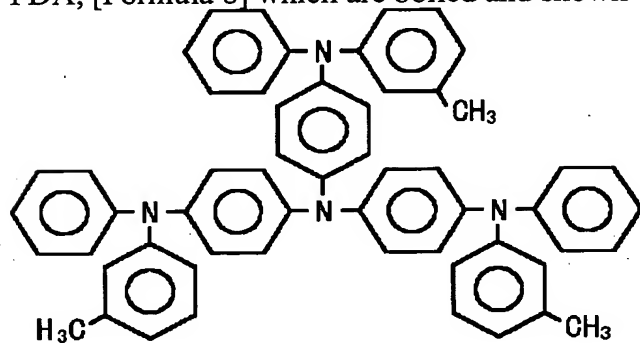
The kappa phthalocyanine boiled and shown, [Formula 6]



TPAC, [Formula 7] which are boiled and shown

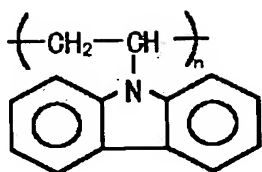


PDA, [Formula 8] which are boiled and shown

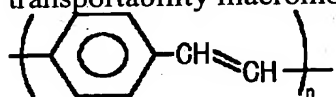


It is desirable for it to be alike and to consist of shown m-MTDATA, a derivative of each above-mentioned compound, etc.

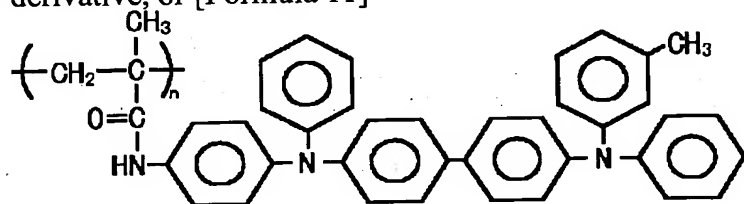
[0049] As an electron hole transportability macromolecule, it is [Formula 9].



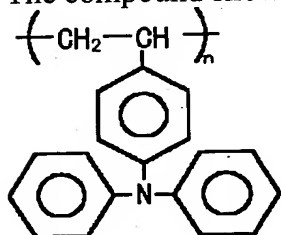
It is desirable for it to be alike and to consist of electron hole transportability macromolecules, such as shown Pori (N-vinylcarbazole) (for it to also be called Following PVK), polyvinyl naphthalene, a polyvinyl anthracene, a polyvinyl phenanthrene, a polyvinyl pyrene, and polyvinyl perylene. [0050] Or they are Pori (PARAFENIREN) and its derivative, and [Formula 10] as an electron hole transportability macromolecule.



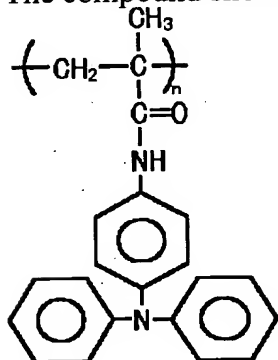
Conductive polymer emitters, such as Pori (Para-phenylenevinylene) boiled and shown and its derivative, or [Formula 11]



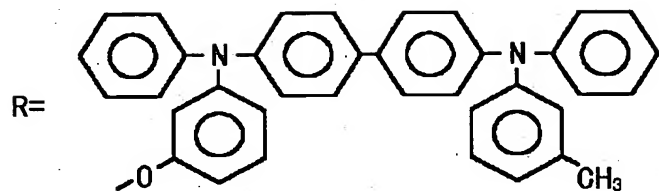
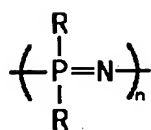
The compound shown with a chemical formula [-izing 11] and its derivative, [Formula 12]



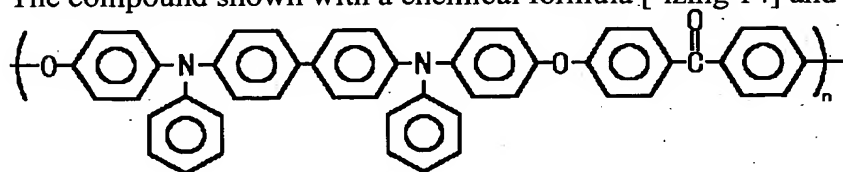
The compound shown with a chemical formula [-izing 12] and its derivative, [Formula 13]



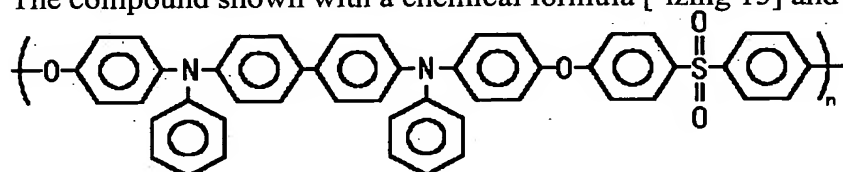
The compound shown with a chemical formula [-izing 13] and its derivative, [Formula 14]



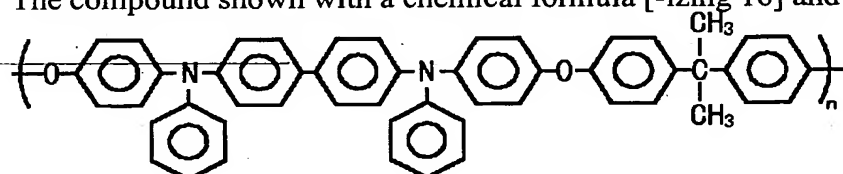
The compound shown with a chemical formula [-izing 14] and its derivative, [Formula 15]



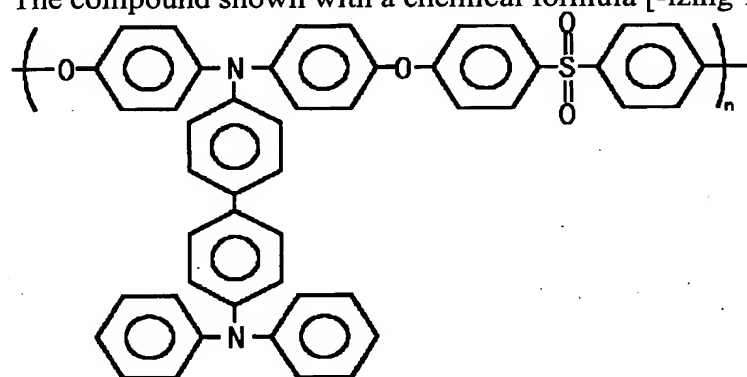
The compound shown with a chemical formula [-izing 15] and its derivative, [Formula 16]



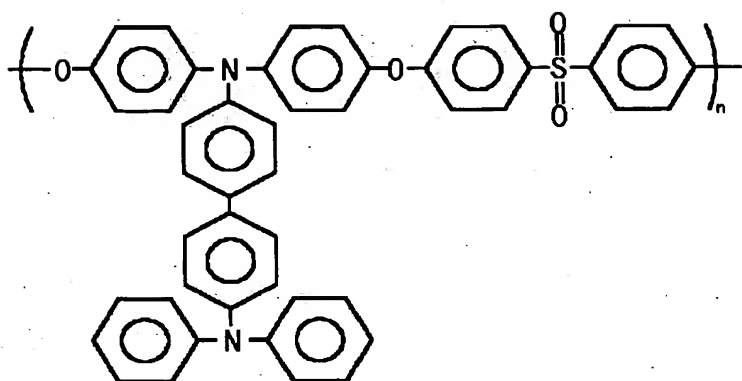
The compound shown with a chemical formula [-izing 16] and its derivative, [Formula 17]



The compound shown with a chemical formula [-izing 17] and its derivative, [Formula 18]

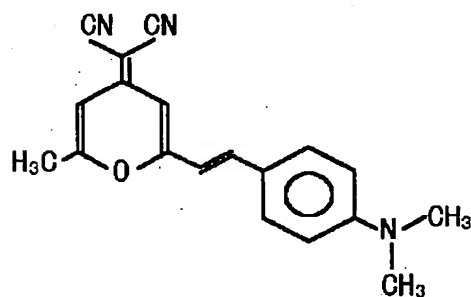


The compound shown with a chemical formula [-izing 18] and its derivative, [Formula 19]

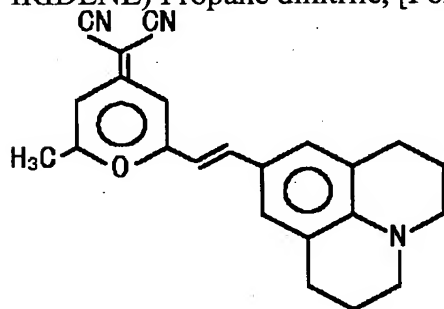


It is desirable to consist of conductive polymer emitters, such as a compound shown with a chemical formula [izing 19] and its derivative.

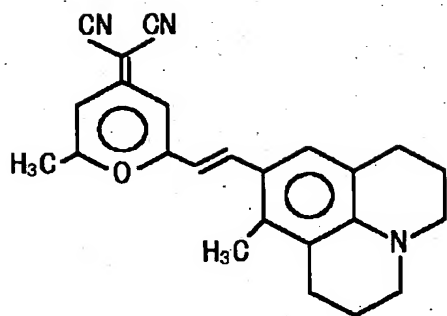
[0051] Moreover, a coumarin 1, a coumarin 2, a coumarin 6, a coumarin 7, a coumarin 30, a coumarin 102, a coumarin 106, a coumarin 334, a coumarin 337, a coumarin 4, a coumarin 314, a coumarin 153, coumarin 3CA, a coumarin 307, coumarin 314T, as a fluorescent material A coumarin 338, a coumarin 500, a coumarin 138, a coumarin 152, a coumarin 151, a coumarin 339, a 3-(2-benzothiazolyl)-7-(dibutylamino) coumarin, A 3-(2-benzothiazolyl)-7-(diheptyl amino) coumarin, A 3-(2-benzothiazolyl)-7-(dioctylamino) coumarin, 10-(2-benzothiazolyl)-2, 3 and 6, 7-tetrahydro - Coumarin derivatives, such as 1, 1, 7, 7-tetramethyl 1H, 5H, and 11H-[1] benzo PIRANO [6, 7, 8-ij] coumarin-11-one, [Formula 20]



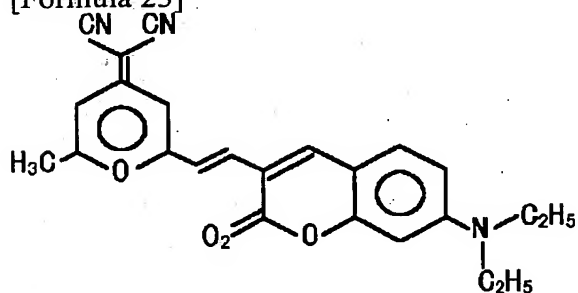
The propane dinitrile boiled and shown (2-(2-(4-(dimethylamino) phenyl) ethenyl)-6-methyl-4H-pyran-4-IRIDENE) (it is also called Following DCM), Propane dinitrile, (2-(2-(4-(dipropylamino) phenyl) ethenyl)-6-methyl-4H-pyran-4-IRIDENE) Propane dinitrile, (2-(2-(4-(dibutylamino) phenyl) ethenyl)-6-methyl-4H-pyran-4-IRIDENE) (2-(2-(4-(dioctylamino) phenyl) ethenyl)-6-methyl-4H-pyran-4-IRIDENE) Propane dinitrile, [Formula 21]



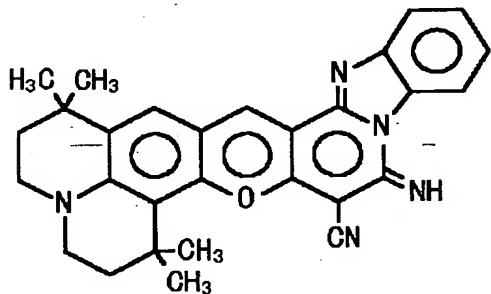
[Formula 22]



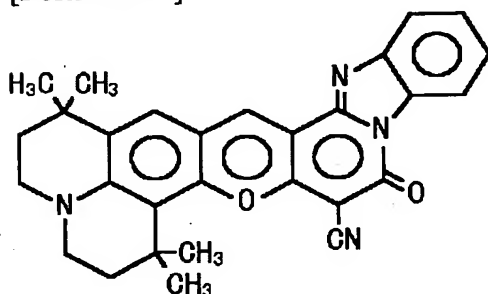
[Formula 23]



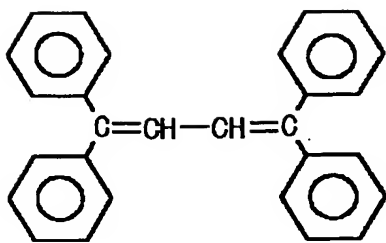
DCM system compounds, such as a compound shown by the chemical formula [-izing 21], [-izing 22], and [-izing 23], [Formula 24]



[Formula 25]



The derivative of aromatic amines, such as coloring matter, such as a compound shown by the chemical formula [-izing 24] and [-izing 25], and the Nile red, 5, 6 and 11, a 12-tetra-phenyl naphthacene (henceforth rubrene), Quinacridone, an anthracene, and an amine system, and an aromatic series imine, [Formula 26]



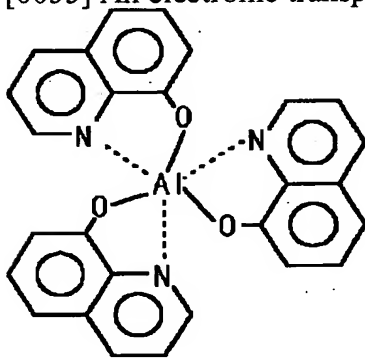
1, 1', 4, and 4'-tetra-phenyl-1,3-butadiene boiled and shown (it is also called Following TPB), The 1-(9-anthracenyl)-4-phenyl-1,3-butadiene, Butadiene derivatives, such as 1-(4-quinolyl)-4-(p-dimethylamino) phenyl-1,3-butadiene, The derivative of stilbenes, such as a derivative [of an acridine], 4, and 4'-screw (5-methyl-2-benzoxazolyl) stilbene, The compound in which excimers, such as derivative [of iso benzofurans, such as 1 and 3-iso benzofuran], 1, and 3-JIPIRE nil propane, or exciplex luminescence is shown, Benzoxadiazole derivatives, such as 7-(p-methoxy benzylamino)-4-nitro benzoxadiazole, Fluorescent brighteners, such as oxazole, OKISA diazo-RU, benzimidazole, and a thiazole derivative, 8-hydroxyquinoline and the metal complex of the derivative, a ruthenium complex, Rare earth salt, such as a metal complex of fluorescence which is represented by the europium complex of a rare earth complex, a benzoyl trifluoro acetone, floyltri fluoroacetone, and hexafluoroacetone, a rare earth complex, or a picolinic acid terbium, etc. can be raised.

[0052] The high molecular compound as a binder Polystyrene, a polyvinyl biphenyl, A polyvinyl phenanthrene, a polyvinyl anthracene, polyvinyl perylene, Pori (ethylene-co-vinyl acetate), cis and trans of polybutadiene, Pori (2-vinyl naphthalene), a polyvinyl pyrrolidone, polystyrene, Pori (methyl methacrylate), Pori (vinyl acetate), Pori (2-vinylpyridine-co-styrene), The poly acenaphthylene, Pori (acrylonitrile-co-butadiene), Pori (benzyl methacrylate), Pori (vinyltoluene), Pori (styrene-co-acrylonitrile), Pori (4-vinyl biphenyl), a polyethylene glycol, etc. are mentioned.

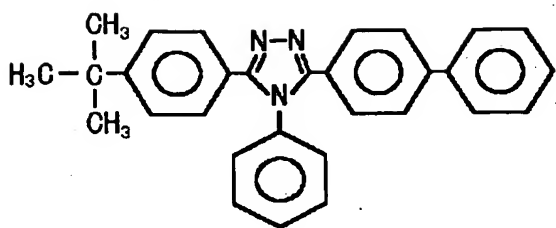
[0053] It consists of the electronic transportability organic substance which consists of an electronic transportation agent or an electronic transportability macromolecule as an electronic transportation layer 30. As for the electronic transportability organic substance, an electronic transportability low-molecular or an electronic transportability macromolecule is used.

[0054] Here, as shown in drawing 3 (a), the configuration which the electronic transportation layer 30 becomes from an electronic transportability emitter is possible. Moreover, as shown in drawing 4 (a), the configuration which the electronic transportation layer 30 becomes from a fluorescent material and the electronic transportability organic substance is also possible. Furthermore, the configuration which contains the high molecular compound as a binder in the electronic transportation layer 30 is also possible.

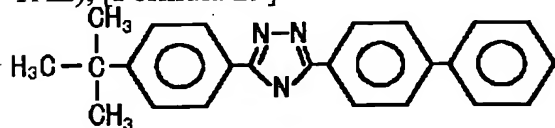
[0055] An electronic transportability low-molecular is [Formula 27].



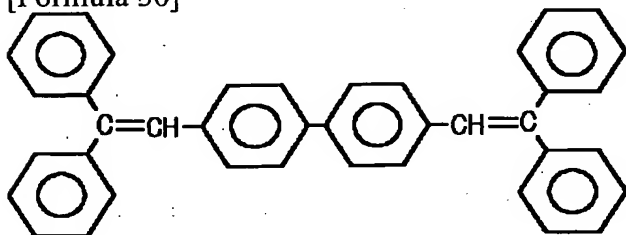
Tris(8-hydroxyquinolate)aluminium shown in [-izing 27] (it is also called the following Alq3), [Formula 28]



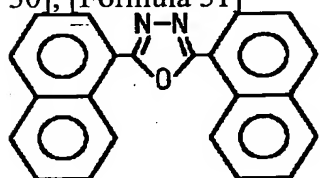
3-(4-biphenyl)-5-(4-tert-butylphenyl)-4-phenyl shown in [-izing 28] - 1, 2, 4-triazole (henceforth TAZ), [Formula 29]



2-(4-biphenyl)-5-(4-tert-butylphenyl)- shown in [-izing 29] -- 1, 3, and 4-OKISA diazole (it is also called Following PBD), [Formula 30]

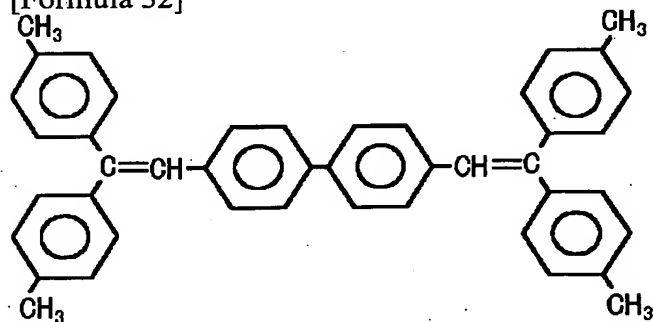


The 4 and 4'-screw (1 and 1-diphenyl ethenyl) biphenyl (DPVBi is also told to below) shown in [-izing 30], [Formula 31]

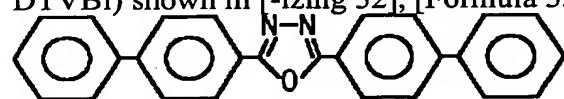


2, 5-screw (1-naphthyl)-1.3.4-OKISA diazole (BND is also told to the below) which are shown in [-izing 31]

[Formula 32]

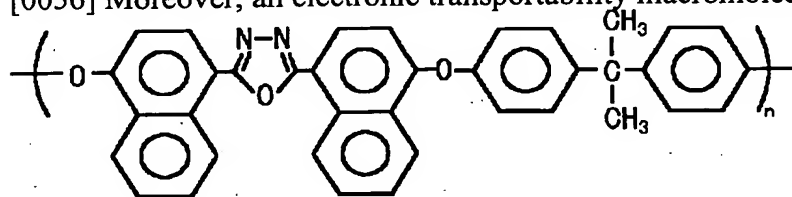


The 4 and 4'-screw (1 and 1-screw (4-methylphenyl) ethenyl) biphenyl (it is also called Following DTVBi) shown in [-izing 32], [Formula 33]

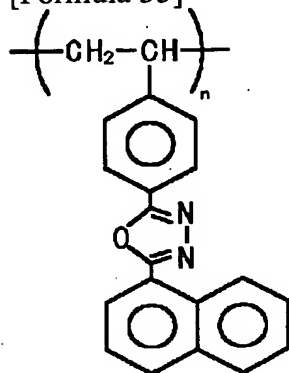


2, 5-screw (4-biphenyl) which are shown in [-izing 33] - 1, 3, and 4-OKISA diazole (it is also called Following BBD) etc. can be mentioned.

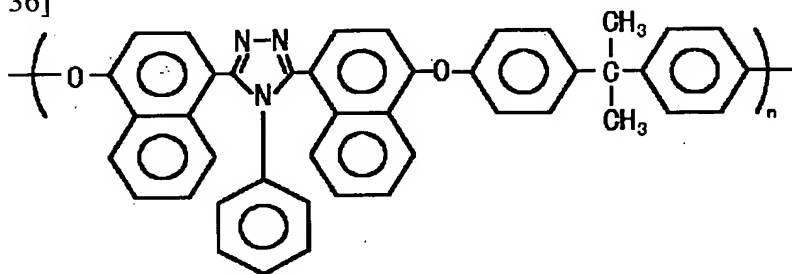
[0056] Moreover, an electronic transportability macromolecule is [Formula 34].



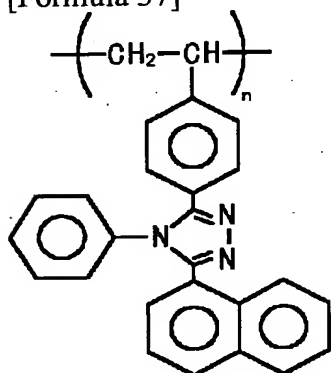
[Formula 35]



An OKISA diazole system high molecular compound as shown by [-izing 34] and [-izing 35], [Formula 36]



[Formula 37]



A triazole system high molecular compound as shown by [-izing 36] and [-izing 37] etc. is mentioned.

[0057] That the high molecular compound as a binder was indicated to be above is used.

[0058] Catholyte 40 acts as cathode. A tetrahydro aluminate is used for catholyte 40. Especially as a

tetrahydro aluminate used for catholyte 40, a lithium aluminum hydride, a hydrogenation aluminum potassium, hydrogenation aluminum caesium, hydrogenation aluminum beryllium, hydrogenation aluminum magnesium, and hydrogenation aluminum calcium can mention. In this, the lithium aluminum hydride is especially excellent in the electron injection nature to an electronic transportation layer. [0059] Next, the manufacture method in the 1st operation gestalt in the organic electroluminescent element of this invention is explained.

[0060] First, the anode plate layer 10 is vapor-deposited on a transperence substrate like a glass substrate. At this time, the anode plate layer 10 is formed using a transparent material. Moreover, the anode plate layer 10 can also use the commercial ITO glass which acts as an anode plate.

[0061] Next, the electron hole transportation layer 20 is formed on the anode plate layer 10 using the method learned conventionally. At this time, it is possible to form the electron hole transportation layer 20 which consists of an electron hole transportability emitter, or to form the electron hole transportation layer 20 which consists of a fluorescent material and the electron hole transportability organic substance.

[0062] Next, the electronic transportation layer 30 is formed on the electron hole transportation layer 20 using the method learned conventionally. At this time, it is possible to form the electronic transportation layer 30 which consists of an electronic transportability emitter, or to form the electronic transportation layer 30 which consists of a fluorescent material and the electronic transportability organic substance.

[0063] Finally the solution which dissolved the tetrahydro aluminate in the solvent is created, and catholyte 40 is created on the electronic transportation layer 30 with a wet method using the solution.

[0064] The usual coating methods, such as for example, the casting method, the blade coat method, a dip painting method of construction, a spin coat method, a spray coating method, a roll coating method, and an ink jet coating method, are included in the wet method used by this invention.

[0065] The organic electroluminescent element of this invention is manufactured according to the above-mentioned production process.

[0066] In this manufacture method, if commercial ITO glass is used for the anode plate layer 10 and the electron hole transportation layer 20 and the electronic transportation layer 30 are created using a wet method, there will be no production process which uses dry process, such as vacuum deposition, for a manufacturing process, and it will become possible to raise productive efficiency.

[0067] Moreover, when the electron hole transportation layer 20 and the electronic transportation layer 30 are created using both wet methods, as for the solvent used for formation of an electronic transportation layer, it is desirable to use the solvent whose solubility of the water to the inside of the solvent in a room temperature it is the solvent which has the meltable solubility parameter of the solubility parameter of the organic substance in said electron hole transportation layer in the membrane formation temperature of said electronic transportation layer out of range, and is 2 or less % of the weight. Furthermore, it is more desirable to use the solvent whose solubility of the water to the inside of the solvent in a room temperature is 1 or less % of the weight. When this loses the elution of the organic substance which constitutes an electron hole transportation layer and an electronic transportation layer is formed, the moisture in a solvent solution remains, a void occurs in the interface of an electron hole transportation layer and an electronic transportation layer, or degrading a luminescence property is lost. The mixed solvent which consists of two or more kinds of solvents is sufficient as the 2nd solvent here. alpha-chloronaphthalene, 2, and 2-dimethyl butane, 2, 4-dimethyl pentane, 2-methyl hexane, 3-methyl hexane, 2,2,4-trimethylpentane, 2-methyl butane, 2 and 2, a 5-trimethyl hexane, 1,1,2-trichloro-1,2,2-trifluoroethane, 1-pentene, 2 and 2, a 3-trimethyl pentane, 2-methyl pentane, N pentane, a trans-2-pentene, 1-hexene, a cis-2-pentene, 2-chloro-isobutane, 1,1,2,2-tetrachloro-1,2-difluoroethane, To 1-, PUTEN, a hexane, n-octane, 1-octene, a heptane, n-nonane, 1-nonene, n-Deccan, 1-chloro pentane, 1-decene, 2-chloro butane, benzo trifluoride, a methylcyclohexane, Methylcyclopentane, 2-chloropropane, a mesitylene, 1-chloro butane, Ethylcyclohexane, para xylene, meta xylene, 2-bromopropane, A cyclohexene, a cyclopentane, 1-chloropropane, a cyclohexane, 2, 3-dimethyl butane, O-xylene, tetrachloromethane, hexafluoro benzene, Pentachloroethane, 1-chloro-isobutane, 1,1-dichloroethylene, 1, 1, 1, 2-tetrachloroethane, 1,1,1-trichloroethane, 1-bromopropane, a cumene, p-chloro toluene, diethyl

SURUFAIDO, Ortho chlorotoluene, p-dichlorobenzene, 1,1-dichloroethane, Tetrachloroethylene, m-dichlorobenzene, p-diethylbenzene, m-diethylbenzene, ethylbenzene, a trichloroethylene, 3-chloropropene, o-diethylbenzene, o-dichlorobenzene, bromoethane, toluene, A chlorobenzene, trichloromethane, a fluorobenzene, 1,2-dichloroethylene (trans), 1,1,2,2-tetrachloroethane, 1,2-dichloropropane, Benzene, 1,2,3-trichloropropane, styrene, isobutyronitrile, 1,2-dichloroethylene (cis), 1-BUROMO-2-chloroethane, 1,2-dichloroethane, hexa chloroethylene, 1,2-dibromoethane, These mixed solvents, such as 1,1,2-trichloroethane, dichloromethane, valeronitrile, a thiophene, carbon JISURUFAIDO, chlorobromomethane, a bromobenzene, 2-nitropropane, 1-nitropropane, a benzonitrile, and nitroethane, are mentioned.

[0068] When an electron hole transportation layer consists of Pori (N-vinylcarbazole) among these solvents, the solvent used when forming an electronic transportation layer In a room temperature, it has or less 8.8(cal/cm³)^{1/2}, and 10.1(cal/cm³)^{1/2} or more solubility parameters. It is desirable that it is the weak solvent of hydrogen bond, such as a hydrocarbon except the strong solvent of hydrogen bond, such as a ketone, ester, the ether, alcohol, a carboxylic acid, an amine, and aldehydes, halogenated hydrocarbon, a nitration hydrocarbon, and nitril. The mixed solvent which consists of two or more kinds of solvents is sufficient as the 2nd solvent here. alpha-chloronaphthalene, 2, and 2-dimethyl butane, 2, 4-dimethyl pentane, 2-methyl hexane, 3-methyl hexane, 2,2,4-trimethylpentane, 2-methyl butane, 2 and 2, a 5-trimethyl hexane, 1,1,2-trichloro-1,2,2-trifluoroethane, 1-pentene, 2 and 2, a 3-trimethyl pentane, 2-methyl pentane, N pentane, a trans-2-pentene; 1-hexene, a cis-2-pentene, 2-chloro-isobutane, 1,1,2,2-tetrachloro-1,2-difluoroethane, To 1-, PUTEN, a hexane, n-octane, 1-octene, a heptane, n-nonane, 1-nonene, n-Deccan, 1-chloro pentane, 1-decene, 2-chloro butane, benzo trifluoride, a methylcyclohexane, Methylcyclopentane, 2-chloropropane, a mesitylene, 1-chloro butane, Ethylcyclohexane, para xylene, meta xylene, 2-bromopropane, A cyclohexene, a cyclopentane, 1-chloropropane, a cyclohexane, 2, 3-dimethyl butane, O-xylene, tetrachloromethane, hexafluoro benzene, Pentachloroethane, 1-chloro-isobutane, 1,1-dichloroethylene, 1, 1, 1, 2-tetrachloroethane, 1,1,1-trichloroethane, 1-bromopropane, a cumene, p-chloro toluene, diethyl SURUFAIDO, Ortho chlorotoluene, p-dichlorobenzene, 1,1-dichloroethane, These mixed solvents, such as tetrachloroethylene, m-dichlorobenzene, p-diethylbenzene, m-diethylbenzene, ethylbenzene, 2-nitropropane, 1-nitropropane, a benzonitrile, and nitroethane, are desirable.

[0069] Furthermore, the degree of aqueous solution to the solvent used at the time of the electronic transportation stratification in a room temperature is 2 or less % of the weight, and it is more desirable that it is 1 or less % of the weight. Thereby, when an electronic transportation layer is formed, the moisture in a solvent solution remains, a void occurs in the interface of a lower layer and the upper layer, or degrading a luminescence property is lost.

[0070] Similarly, the degree of aqueous solution to the solvent used at the time of the electron hole transportation stratification in a room temperature is 2 or less % of the weight, and it is more desirable that it is 1 or less % of the weight.

[0071] Moreover, diethylether, toluene, a tetrahydrofuran, 1, 2-dimethoxyethane, a diethylene glycol, and wood ether are used as a solvent used when creating catholyte 40 using a wet method.

[0072] Here, as for the solvent used in catholyte 40 at the time of formation, it is desirable to use the solvent whose solubility of the water to the inside of the solvent in a room temperature is 2 or less % of the weight. Thereby, when catholyte 40 is formed, the moisture in a solvent solution remains, a void occurs in the interface of catholyte 40 and the electronic transportation layer 30, or degrading a luminescence property is lost. Diethylether and toluene are used as a solvent whose solubility of the water to the inside of the solvent in such a room temperature is 2 or less % of the weight. Moreover, in catholyte 40, when the membrane formation ambient atmosphere at the time of formation is formed by desiccation nitrogen-gas-atmosphere mind, diethylether, toluene, a tetrahydrofuran, 1, 2-dimethoxyethane, a diethylene glycol, and wood ether are used as a solvent.

[0073] Next, the 2nd operation gestalt in the organic electroluminescent element of this invention is shown below.

[0074] Drawing 2 shows the 2nd operation gestalt in the organic electroluminescent element of this

invention.

[0075] According to drawing 2, the anode plate layer 10, the electron hole transportation layer 20, the electronic transportation layer 30, the electron injection layer 41, and catholyte 50 are carrying out the laminating of the configuration of the 2nd operation gestalt in the organic electroluminescent element of this invention one by one.

[0076] The anode plate layer 10 acts as an anode plate. As an anode plate layer 10, the transparent conductive material formed on the transparence insulation base material, for example, a glass substrate, is used.

[0077] Moreover, the anode plate layer 10 needs to be formed with a transparent material. This is because the colored tetrahydro aluminate is used for the electron injection layer 41, as shown below.

[0078] It consists of the electron hole transportability organic substance which consists of an electron hole transportation agent or an electron hole transportability macromolecule as an electron hole transportation layer 20. As for the electron hole transportability organic substance, an electron hole transportability low-molecular or an electron hole transportability macromolecule is used.

[0079] Here, as shown in drawing 3 (c), the configuration which the electron hole transportation layer 20 becomes from an electron hole transportability emitter is possible. Moreover, as shown in drawing 4 (c), the configuration which the electron hole transportation layer 20 becomes from a fluorescent material and the electron hole transportability organic substance is also possible.

[0080] It consists of the electronic transportability organic substance which consists of an electronic transportation agent or an electronic transportability macromolecule as an electronic transportation layer 30. As for the electronic transportability organic substance, an electronic transportability low-molecular or an electronic transportability macromolecule is used.

[0081] Here, as shown in drawing 3 (d), the configuration which the electronic transportation layer 30 becomes from an electronic transportability emitter is possible. Moreover, as shown in drawing 4 (d), the configuration which the electronic transportation layer 30 becomes from a fluorescent material and the electronic transportability organic substance is also possible.

[0082] The material used for the anode plate layer 10, the electron hole transportation layer 20, and the electronic transportation layer 30 is the same as them in the 1st operation gestalt of this invention.

[0083] The electron injection layer 41 is a layer which makes easy impregnation of the electron to the electronic transportation layer 30, and is prepared on the electronic transportation layer 30.

[0084] A tetrahydro aluminate is used for the electron injection layer 41. Especially as a tetrahydro aluminate used for the electron injection layer 41, a lithium aluminum hydride, a hydrogenation aluminum potassium, hydrogenation aluminum caesium, hydrogenation aluminum beryllium, hydrogenation aluminum magnesium, and hydrogenation aluminum calcium can mention. In this, the lithium aluminum hydride is especially excellent in the electron injection nature to the electronic transportation layer 30.

[0085] Catholyte 50 acts as cathode and is prepared on the electron injection layer 41.

[0086] The translucence or opaque electrode layer which one desirable as catholyte 50 compounded metals and rare earth simple substances, such as an indium, silver, gold, copper, tin, aluminum, lead, magnesium, a lithium, a lanthanum, europium, and an ytterbium, lithium fluoride, or these, and was formed is mentioned.

[0087] Next, the manufacture method in the 2nd operation gestalt in the organic electroluminescent element of this invention is explained.

[0088] First, the anode plate layer 10 is vapor-deposited on a transparence substrate like a glass substrate. At this time, the anode plate layer 10 is formed using a transparent material. Moreover, the anode plate layer 10 can also use the commercial ITO glass which acts as an anode plate.

[0089] Next, the electron hole transportation layer 20 is formed on the anode plate layer 10 using the method learned conventionally. At this time, it is possible to form the electron hole transportation layer 20 which consists of an electron hole transportability emitter, or to form the electron hole transportation layer 20 which consists of a fluorescent material and the electron hole transportability organic substance.

[0090] Next, the electronic transportation layer 30 is formed on the electron hole transportation layer 20 using the method learned conventionally. At this time, it is possible to form the electronic transportation layer 30 which consists of an electronic transportability emitter, or to form the electronic transportation layer 30 which consists of a fluorescent material and the electronic transportability organic substance.

[0091] Next, the solution which dissolved the tetrahydro aluminate in the solvent is created, and the electron injection layer 41 is created on the electronic transportation layer 30 with a wet method using the solution.

[0092] The usual coating methods, such as for example, the casting method, the blade coat method, a dip painting method of construction, a spin coat method, a spray coating method, a roll coating method, and an ink jet coating method, are included in the wet method used by this invention.

[0093] Finally, catholyte 50 is formed with vacuum deposition etc. on the electron injection layer 41.

[0094] The organic electroluminescent element of this invention is manufactured according to the above-mentioned production process.

[0095] With the 2nd operation gestalt in the organic electroluminescent element of this invention, it makes it possible to form the electron injection layer 41 currently formed by the conventional vacuum deposition etc. using a wet method.

[0096] Moreover, the tetrahydro aluminate used for the electron injection layer 41 is excellent in the electron injection nature to an electronic transportation layer. For this reason, as compared with the element which does not have the electron injection layer 41, the element by the 2nd operation gestalt of this invention enables the fall of driver voltage.

[0097] Here, diethylether, toluene, a tetrahydrofuran, 1, 2-dimethoxyethane, a diethylene glycol, and wood ether are used as a solvent used when creating the electron injection layer 41 using a wet method. These are the same as what is used at the time of catholyte 40 formation with the 1st operation gestalt of this invention.

[0098] Moreover, as for the solvent used in the electron injection layer 41 at the time of formation, it is desirable to use the solvent whose solubility of the water to the inside of the solvent in a room temperature is 2 or less % of the weight. Thereby, when the electron injection layer 41 is formed, the moisture in a solvent solution remains, a void occurs in the interface of the electron injection layer 41 and the electronic transportation layer 30, or degrading a luminescence property is lost. Diethylether and toluene are used as a solvent whose solubility of the water to the inside of the solvent in such a room temperature is 2 or less % of the weight. Moreover, in the electron injection layer 41, when the membrane formation ambient atmosphere at the time of formation is formed by desiccation nitrogen-gas-atmosphere mind, diethylether, toluene, a tetrahydrofuran, 1, 2-dimethoxyethane, a diethylene glycol, and wood ether are used as a solvent. Also about these, it is the same as what is used at the time of catholyte 40 formation with the 1st operation gestalt of this invention.

[0099] Moreover, the solvent used when the electron hole transportation layer 20 and the electronic transportation layer 30 are created using both wet methods is the same as what is shown in the 1st operation gestalt of this invention.

[0100] Below, the example of an experiment by this invention person is indicated. The organic electroluminescent element which can set this invention was created, and the brightness and current density of the element when impressing predetermined voltage to the element were measured.

[0101] The organic solvent washed the commercial ITO glass (the Asahi Glass make, 20 ohm/cm²) which acts as a [example 1] anode plate, and after drying the washed ITO glass, UV / ozone washing was performed.

[0102] Next, by using dichloroethane 1ml as a solvent, the solution which dissolved Pori (N-vinylcarbazole) 6mg as the electron hole transportability organic substance into the solvent was created, and the electron hole transportation layer was created with the spin coat method which used the solution on the above-mentioned ITO glass.

[0103] next, dichloroethane 1ml -- a solvent -- carrying out -- the inside of the solvent -- as the electronic transportability organic substance -- 4 and 4'-screw (1 and 1-diphenyl ethenyl) PIFENIRU and Pori (4-vinyl biphenyl) -- moreover, the solution which dissolved the coumarin 6 as a fluorescent

material was created, and the electronic transportation layer was created with the spin coat method which used the solution on the above-mentioned electron hole transportation layer.

[0104] next -- as a solvent -- diethylether 1ml -- the cathode which consists of a lithium aluminum hydride was created with the spin coat method which used the solution for inside on the above-mentioned electronic transportation layer using the solution which melted 37.95mg of lithium aluminum hydrides, and the organic electroluminescent element in the 1st operation gestalt of this invention was created.

[0105] Brightness in case applied voltage is 20V to this element was 18 cd/m². Moreover, the current density of the element at this time was 3.6 mA/cm².

[0106] The organic solvent washed the commercial ITO glass (the Asahi Glass make, 20 ohm/cm²) which acts as a [example 2] anode plate, and after drying the washed ITO glass, UV / ozone washing was performed.

[0107] Next, by using dichloroethane 1ml as a solvent, the solution which dissolved Pori (N-vinylcarbazole) 6mg as the electron hole transportability organic substance into the solvent was created, and the electron hole transportation layer was created with the spin coat method which used the solution on the above-mentioned ITO glass.

[0108] next, dichloroethane 1ml -- a solvent -- carrying out -- the inside of the solvent -- as the electronic transportability organic substance -- 4 and 4'-screw (1 and 1-diphenyl ethenyl) PIFENIRU and Pori (4-vinyl biphenyl) -- moreover, the solution which dissolved the coumarin 6 as a fluorescent material was created, and the electronic transportation layer was created with the spin coat method which used the solution on the above-mentioned electron hole transportation layer.

[0109] next -- as a solvent -- diethylether 1ml -- the electron injection layer which consists of thickness of 2nm of lithium aluminum hydrides was created with the spin coat method which used the solution for inside on the above-mentioned electronic transportation layer using the solution which melted 3mg of lithium aluminum hydrides.

[0110] The organic electroluminescent element which uses a vacuum evaporation system, finally mixes Mg and Ag at a rate of the element ratio 10:1 in pressure 10-3Pa, carries out vapor codeposition to 200nm thickness at the rate of 1 nm/sec, forms cathode on the above-mentioned electron injection layer, and can set the 2nd operation gestalt of this invention was created.

[0111] Brightness in case applied voltage is 18V to this element was 645 cd/m². Moreover, the current density of the element at this time was 31 mA/cm².

[0112] The element without an electron injection layer was created as compared with [the example 1 of a comparison], and the [example 2], and the brightness and current density of the element when impressing predetermined voltage to the element were measured. The organic solvent washed the commercial ITO glass (the Asahi Glass make, 20 ohm/cm²) which acts as an anode plate, and after drying the washed ITO glass, UV / ozone washing was performed.

[0113] Next, by using dichloroethane 1ml as a solvent, the solution which dissolved Pori (N-vinylcarbazole) 6mg as the electron hole transportability organic substance into the solvent was created, and the electron hole transportation layer was created with the spin coat method which used the solution on the above-mentioned ITO glass.

[0114] next, dichloroethane 1ml -- a solvent -- carrying out -- the inside of the solvent -- as the electronic transportability organic substance -- 4 and 4'-screw (1 and 1-diphenyl ethenyl) PIFENIRU -- as a binder macromolecule -- Pori (4-vinyl biphenyl) -- moreover, the solution which dissolved the coumarin 6 as a fluorescent material was created, and the electronic transportation layer was created with the spin coat method which used the solution on the above-mentioned electron hole transportation layer.

[0115] Finally, the vacuum evaporation system was used, Mg and Ag were mixed at a rate of the element ratio 10:1 in pressure 10-3Pa, on the above-mentioned electronic transportation layer, vapor codeposition was carried out to 200nm thickness at the rate of 1 nm/sec, cathode was formed, and the organic electroluminescent element was created.

[0116] Brightness in case applied voltage is 18V to this element was 356 cd/m². Moreover, the current

density of the element at this time was 20 mA/cm².

[0117] What changed only the electron injection layer was created as compared with the element created in [examples 3-7] and the [example 2], and the brightness and current density of the element when impressing predetermined voltage to the element were measured.

[0118] With the element of [an example 3], the solution used for electron injection layer creation time was changed into the diethylether solution of a hydrogenation aluminum potassium, and the electron injection layer which consists of a hydrogenation aluminum potassium was created.

[0119] With the element of [an example 4], the solution used for electron injection layer creation time was changed into the diethylether solution of hydrogenation aluminum caesium, and the electron injection layer which consists of hydrogenation aluminum caesium was created.

[0120] With the element of [an example 5], the solution used for electron injection layer creation time was changed into the diethylether solution of hydrogenation aluminum beryllium, and the electron injection layer which consists of hydrogenation aluminum beryllium was created.

[0121] With the element of [an example 6], the solution used for electron injection layer creation time was changed into the diethylether solution of hydrogenation aluminum magnesium, and the electron injection layer which consists of hydrogenation aluminum magnesium was created.

[0122] With the element of [an example 7], the solution used for electron injection layer creation time was changed into the diethylether solution of hydrogenation aluminum calcium, and the electron injection layer which consists of hydrogenation aluminum calcium was created.

[0123] What measured the class of tetrahydro aluminate used for the electron injection layer in the organic electroluminescent element created in [examples 2-7] by the [table 1] shown below, brightness (unit: cd/m²) in case the applied voltage to each of that element is 18V, and current density (unit: mA/cm²) is shown. Moreover, what measured brightness (unit: d/cm²) and current density (unit: mA/cm²) in case the applied voltage in the organic electroluminescent element created in [the example 1 of a comparison] is 18V is shown for a comparison.

[A table 1]

	テトラヒドロアルミン酸塩の種類	印加電圧 (V)	輝度 (cd/m ²)	電流密度 (mA/cm ²)
実施例 2	水素化アルミニウムリチウム	18	645	31
実施例 3	水素化アルミニウムカリウム	18	522	25
実施例 4	水素化アルミニウムセシウム	18	515	24
実施例 5	水素化アルミニウムベリリウム	18	481	23
実施例 6	水素化アルミニウムマグネシウム	18	550	29
実施例 7	水素化アルミニウムカルシウム	18	577	30
比較例 1	—	18	356	20

[0124] When a tetrahydro aluminate is used for an electron injection layer from the result shown in [a table 1] as compared with the conventional organic electroluminescent element, the brightness and current density to the same applied voltage are large. It became possible from this to reduce the driver voltage for obtaining the same brightness and current density as compared with the conventional organic electroluminescent element.

[0125]

[Effect of the Invention] According to the organic electroluminescent element of this invention, the tetrahydro aluminate is used for an electron injection layer or cathode as explained above. Since this tetrahydro aluminate is excellent in electron injection nature and has fusibility in an organic solvent, it becomes possible [forming an electron injection layer or cathode using a wet method]. Therefore, it becomes possible to manufacture the organic electroluminescent element which is high brightness and was excellent in productivity.

[0126] Furthermore, it becomes possible to manufacture the organic electroluminescent element to which driver voltage was reduced.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is drawing showing the 1st operation gestalt in the organic electroluminescent element of this invention.

[Drawing 2] It is drawing showing the 2nd operation gestalt in the organic electroluminescent element of this invention.

[Drawing 3] The 1st modification of the organic electroluminescent element of this invention shown by drawing 1 and drawing 2 is shown. Drawing 3 (a) The configuration which the electronic transportation layer in the 1st operation gestalt of this invention becomes from an electronic transportability emitter is shown. Drawing 3 (b) The configuration which the electron hole transportation layer in the 1st operation gestalt of this invention becomes from an electron hole transportability emitter is shown. Drawing 3 (c) The configuration which the electron hole transportation layer in the 2nd operation gestalt of this invention becomes from an electron hole transportability emitter is shown, and drawing 3 (d) shows the configuration which the electronic transportation layer in the 2nd operation gestalt of this invention becomes from an electronic transportability emitter.

[Drawing 4] The 2nd modification of the organic electroluminescent element of this invention shown by drawing 1 and drawing 2 is shown. Drawing 4 (a) The configuration which the electronic transportation layer in the 1st operation gestalt of this invention becomes from a fluorescent material and the electronic transportability organic substance is shown. Drawing 4 (b) The configuration which the electron hole transportation layer in the 1st operation gestalt of this invention becomes from a fluorescent material and the electron hole transportability organic substance is shown. Drawing 4 (c) The configuration which the electron hole transportation layer in the 2nd operation gestalt of this invention becomes from a fluorescent material and the electron hole transportability organic substance is shown, and drawing 4 (d) shows the configuration which the electronic transportation layer in the 2nd operation gestalt of this invention becomes from a fluorescent material and the electronic transportability organic substance.

[Description of Notations]

- 10 Anode Plate
- 20 Electron Hole Transportation Layer
- 21 Electron Hole Transportability Emitter
- 22 Fluorescent Material
- 23 Electron Hole Transportability Material
- 30 Electronic Transportation Layer
- 31 Electronic Transportability Emitter
- 32 Fluorescent Material
- 33 Electronic Transportability Material
- 40 Cathode
- 41 Electron Injection Layer
- 50 Cathode

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CLAIMS

[Claim(s)]

[Claim 1] the anode plate layer which acts as an anode plate and consists of a transparent material, the electron hole transportation layer which were prepared on said anode plate layer and which consist of the electron hole transportability organic substance, the electronic transportation layer which were prepared on said electron hole transportation layer and which consist of the electronic transportability organic substance, and the catholyte which consist of a tetrahydro aluminate which used a wet method and was prepared on said electronic transportation layer, and act as cathode -- since -- the organic electroluminescent element become.

[Claim 2] An organic electroluminescent element characterized by providing the following An anode plate layer which acts as an anode plate and consists of a transparent material An electron hole transportation layer which was prepared on said anode plate layer and which consists of the electron hole transportability organic substance, an electronic transportation layer which was prepared on said electron hole transportation layer and which consists of the electronic transportability organic substance, an electron injection layer which used a wet method and was prepared on said electronic transportation layer and which consists of a tetrahydro aluminate, and catholyte which was prepared on said electron injection layer and which acts as cathode

[Claim 3] A method of one at least is an organic electroluminescent element of said electron hole transportability organic substance and said electronic transportability organic substance according to claim 1 or 2 which is a fluorescent material.

[Claim 4] An organic electroluminescent element given in said electron hole transportation layer or said electronic transportation claims 1-3 layer which contains a fluorescent material in a method of one at least.

[Claim 5] An organic electroluminescent element given in either of claims 1-4 which said tetrahydro aluminate becomes from a lithium aluminum hydride, a hydrogenation aluminum potassium, hydrogenation aluminum caesium, hydrogenation aluminum beryllium, hydrogenation aluminum magnesium, or hydrogenation aluminum calcium.

[Claim 6] An organic electroluminescent element given in either of claims 1-4 which said tetrahydro aluminate becomes from a lithium aluminum hydride.

[Claim 7] Said wet method is an organic electroluminescent element given in either of claims 1-6 for which diethylether, toluene, a tetrahydrofuran, 1, 2-dimethoxyethane, a diethylene glycol, or wood ether is used as a solvent.

[Claim 8] Said wet method is an organic electroluminescent element according to claim 7 characterized by being carried out by desiccation nitrogen-gas-atmosphere mind.

[Claim 9] Said wet method is an organic electroluminescent element given in either of claims 1-6 for which diethylether or toluene is used as a solvent.

[Claim 10] A manufacture method of an organic electroluminescent element characterized by providing the following An anode plate stratification step which forms an anode plate layer which acts as an anode plate and consists of a transparent material An electron hole transportation stratification step which

forms an electron hole transportation layer which consists of the electron hole transportability organic substance on said anode plate layer, an electronic transportation stratification step which forms an electronic transportation layer which consists of the electronic transportability organic substance on said electron hole transportation layer, and a catholyte formation step which forms catholyte which uses a wet method and acts as cathode on said electronic transportation layer

[Claim 11] Said catholyte formation step is the manufacture method of an organic electroluminescent element according to claim 10 which consists of a step which forms catholyte with a wet method using a solution which made a solvent dissolve or distribute a tetrahydro aluminate.

[Claim 12] Said catholyte formation step is an organic electroluminescent element according to claim 11 characterized by being carried out by desiccation nitrogen-gas-atmosphere mind.

[Claim 13] A manufacture method of an organic electroluminescent element characterized by providing the following An anode plate stratification step which forms an anode plate layer which acts as an anode plate and consists of a transparent material An electron hole transportation stratification step which forms an electron hole transportation layer which consists of the electron hole transportability organic substance on said anode plate layer An electronic transportation stratification step which forms an electronic transportation layer which consists of the electronic transportability organic substance on said electron hole transportation layer An electron injection stratification step which forms an electron injection layer which consists of a tetrahydro aluminate on said electronic transportation layer with a wet method using a solution which made a solvent dissolve or distribute a tetrahydro aluminate, and a catholyte formation step which forms catholyte which acts as cathode on said electron injection layer

[Claim 14] Said electron injection stratification step is an organic electroluminescent element according to claim 13 characterized by being carried out by desiccation nitrogen-gas-atmosphere mind.

[Claim 15] Said solvent is the manufacture method of an organic electroluminescent element given in either of claims 11-14 which consists of diethylether, toluene, a tetrahydrofuran, 1, 2-dimethoxyethane, a diethylene glycol, or wood ether.

[Claim 16] Said solvent is an organic electroluminescent element given in either of claims 11-14 for which diethylether and toluene are used.

[Claim 17] It is the manufacture method of an organic electroluminescent element given in said electron hole transportability organic substance or said electronic transportability claims 10-16 organic substance whose method of one at least is a fluorescent material.

[Claim 18] A manufacture method of an organic electroluminescent element given in said electron hole transportation layer or said electronic transportation claims 10-17 layer which contains a fluorescent material in a method of one at least.

[Claim 19] A manufacture method of an organic electroluminescent element given in either of claims 10-18 which said tetrahydro aluminate becomes from a lithium aluminum hydride, a hydrogenation aluminum potassium, hydrogenation aluminum caesium, hydrogenation aluminum beryllium, hydrogenation aluminum magnesium, or hydrogenation aluminum calcium.

[Claim 20] An organic electroluminescent element given in either of claims 10-19 which said tetrahydro aluminate becomes from a lithium aluminum hydride.

[Translation done.]

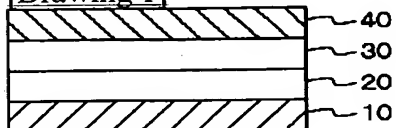
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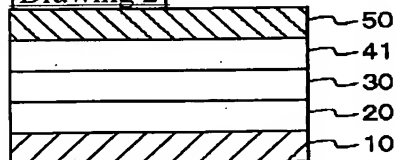
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DRAWINGS

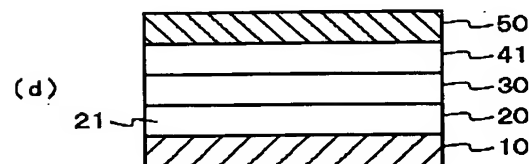
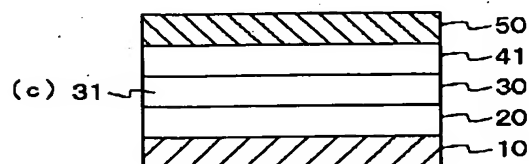
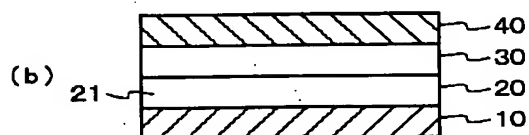
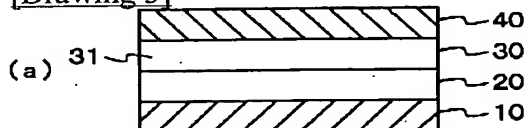
[Drawing 1]



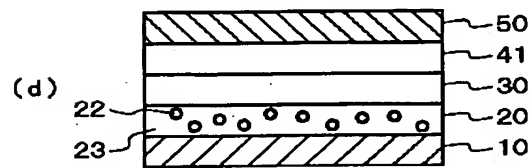
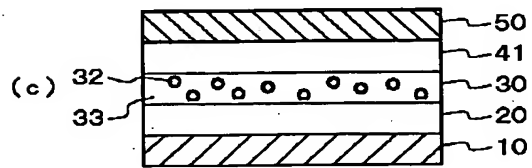
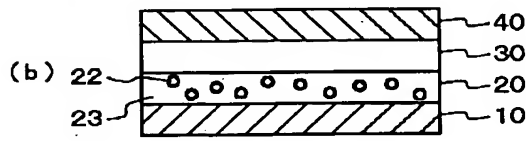
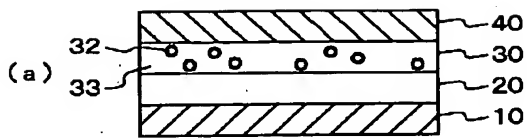
[Drawing 2]



[Drawing 3]



[Drawing 4]



[Translation done.]